Implementing Optimization in the Superfund Program

For the Interagency Performance and Risk Assessment Community of Practice (P&RA CoP)
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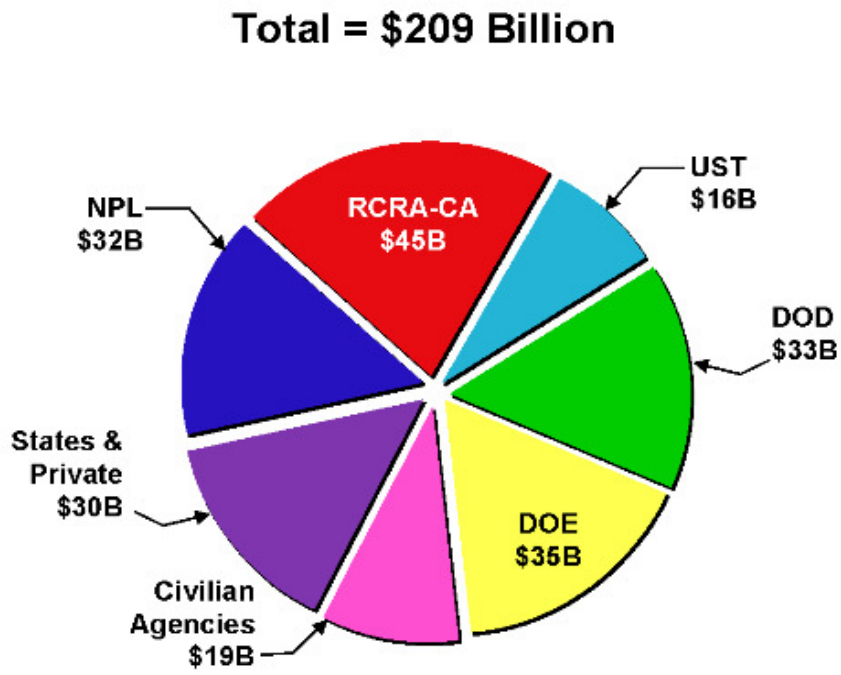
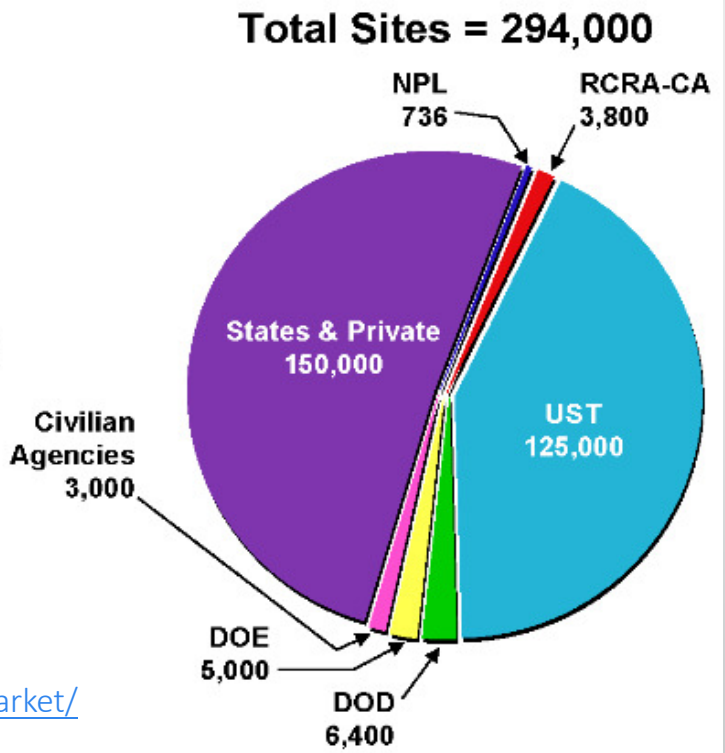
We Have a Lot of Work to Do

(Estimated Number of Contaminated Sites)

(Cleanup Horizon: 2004 - 2033)





Source: www.clu-in.org/market/

Working Definition of Optimization

Systematic site review by a team of independent technical experts, at any phase of a cleanup process, to identify opportunities to improve remedy protectiveness, effectiveness and cost efficiency; and to facilitate progress toward site completion.

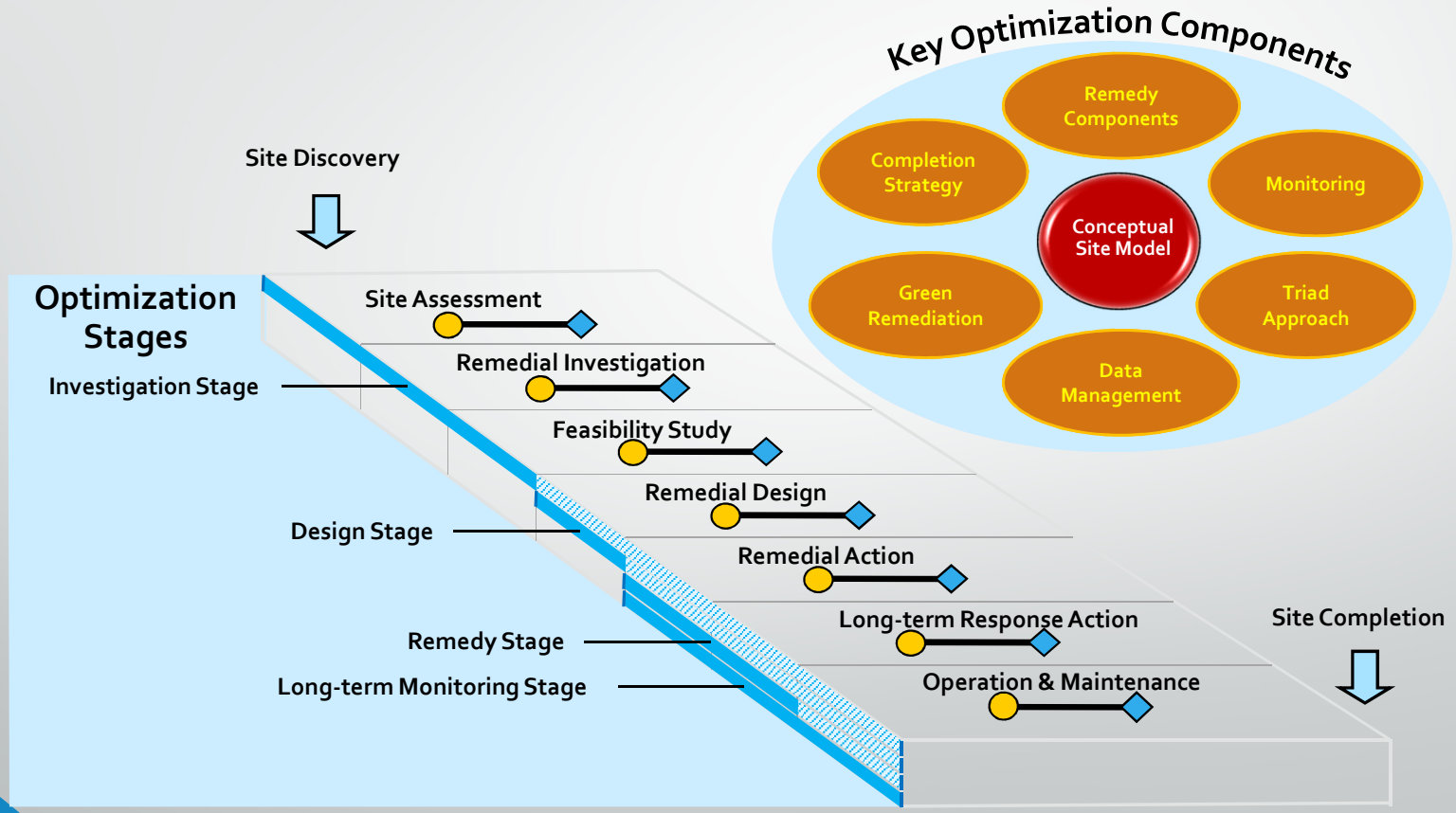
EPA Optimization History

- EPA Optimization starts circa 1997
- EPA-USACE-USAF collaboration during 2000's refines practice. Optimization techniques, practices, events and experience grow through late 1990's and 2000s
- ~100 sites assessed by 2010 with EPA mission support contract and USACE. Good success.
- Late 2010 briefing for Assistant Administrator & Deputy AA for EPA's waste programs (OSWER)
  - Directive: Develop National Optimization Strategy to meet goals
    - Goal: Expand optimization throughout pipeline
    - Goal: Increase number of sites optimized
    - Goal: Expand optimization resource access
    - Goal: Train staff in optimization techniques
    - Goal: Integrate optimization as "institutional" practice within Regions
    - Goal: Measure success
- Strategy developed by National Workgroup (Regions/HQ/ORD) w/full HQ review and approval.
  - "National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion' is signed 9/28/2012
  - Further Implementation 10/2012 – present

EPA's National Optimization Strategy

- Composed of four elements, 32 actions:
  - Planning and Outreach
  - Implementation
  - Communication and Training
  - Measurement
- Leverages regional and HQ resources for reviews.
- Develops regional optimization programs and expertise.
- Tracks optimization results for all reviews.
- Is in full swing during 2016.

Applies to Any Phase of Cleanup Pipeline Focuses on Key Optimization Components



Applies to Any Site or Remedy Type

Types of Sites	Types of Remedies Evaluated
• Industrial facilities • Wood treating facilities • Dry cleaners • Landfills • Mines	• P&T systems • Air sparging/soil vapor extraction • Groundwater recirculation wells • NAPL recovery • Biosparging • *In situ* thermal remediation • *In situ* chemical oxidation • *In situ* bioremediation • Monitored natural attenuation • Sediment capping • Barrier walls • Constructed wetlands • Landfill gas collection • Surface water diversion/collection/treatment

Optimization can be applied to all site types and all remedy types

Sites Types That May Benefit From Optimization

(Based on past experience, current Regional practice)

- Sites with:
  - Protectiveness concerns, high uncertainty.
  - Technological challenges.
  - Data gaps in the CSM.
  - High costs or high projected costs for remedial activities.
  - Interim remedies.
  - GMNUC/HENUC
- Stalled sites not making RAOs.
- In advance of a Five Year Review (FYR).
- After a FYR – with recommendations for optimization.
- Before LTRA transfer.
- Mines (special focus initiative)

Key Superfund Optimization Tools

- **Investigation Process Optimization** – Conceptual site modeling, dynamic work-plans, real-time data collection, field methods, adaptive site management, 3D visualization -- in ***all*** stages of the pipeline.
- **Independent Design Review** – Will proposed design successfully address site conditions? Serves as Value Engineering Screen when properly constructed.
- **Remediation System Evaluation (RSE)** - Assessment of holistic site operation during construction underway or complete
- **Long-Term Monitoring Optimization (LTMO)** - Statistical modeling techniques to maximize remediation effectiveness and minimize cost during operation of the completed remedy
- **Green Remediation Evaluation** – Assessing and reducing the environmental footprint of the site through the pipeline

EPA Headquarters Optimization Leads

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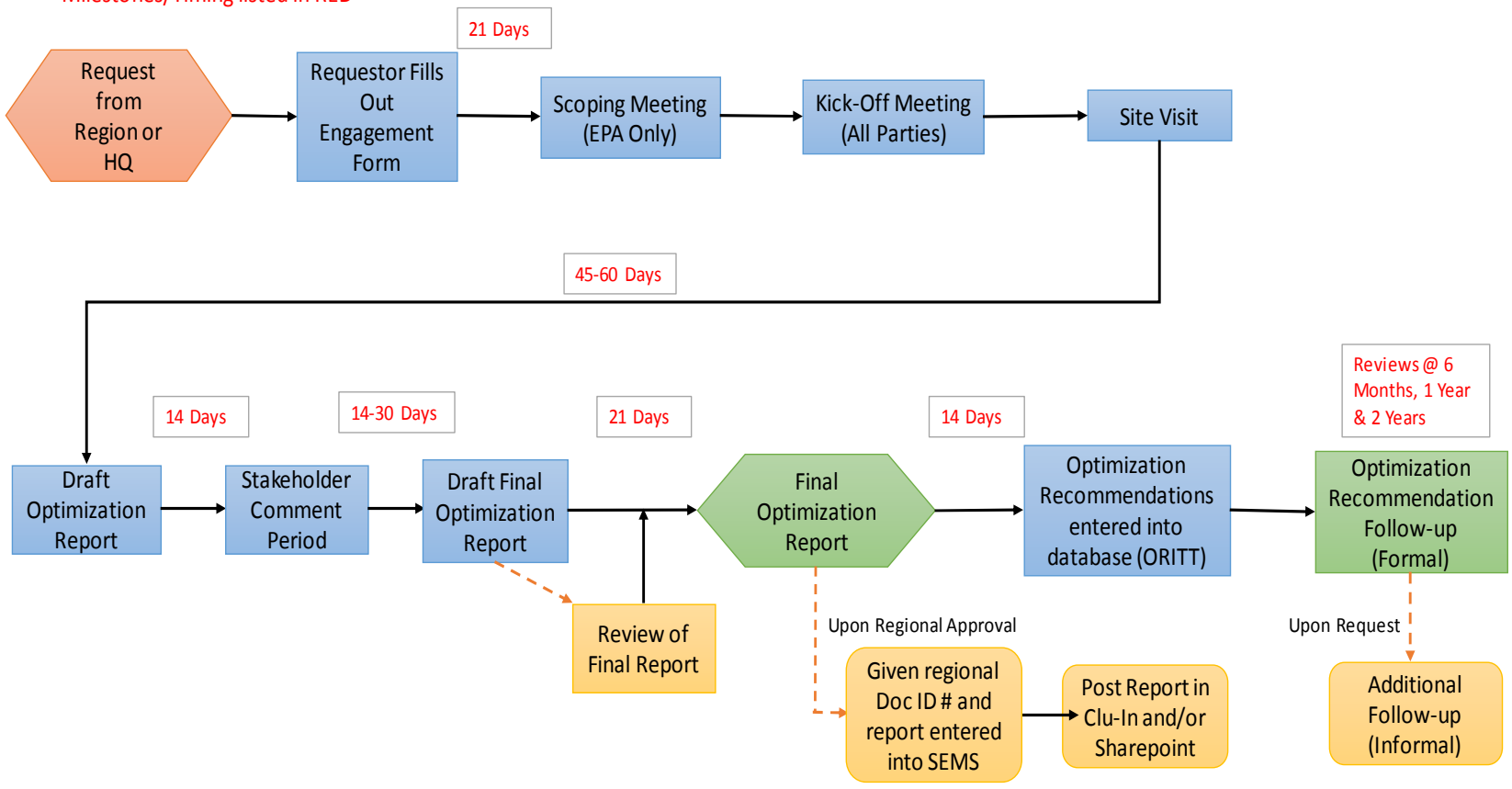
Optimization Review Process

OSRTI OPTIMIZATION PROCESS

Draft Final – 07/01/2015

Milestones/Timing listed in RED



Supporting Documents/Workload

- Optimization Webpage – www.cluin.org/optimization
- Standard Operating Procedure (SOP) (EPA internal)
  - Engagement Form
  - Optimization Primer (on optimization webpage) http://www.cluin.org/Optimization/pdfs/OptimizationPrimer_final_June2013.pdf
  - Review Checklists for each stage
  - Report Templates [flexible], 3DVA, high res technical memoranda [specialty]
  - Recommendations Tracking
- Training Events
  - NARPM 2012, 2013, 2014, 2015
  - Internet seminars (http://cluin.org/studio)
  - National Strategy Workgroup Training Modules
  - HRSC training course
    - Delivered – R2 and R6 / Scheduled – R3, R5 and R9
    - Two course versions – Overburden focus / bedrock focus (new)
- Training Program Development
  - Optimization Training Kit
  - Integration of optimization best practices into CEC courses

Progress of EPA Optimization Support FY11-15

Optimization Events	FY2011	FY2012	FY2013	FY2014	FY2015
Started	18	19	25	19	19
Ongoing from Prior FY(s)	11	22	25	20	10
Completed	7	16	28	25	11

Total: FY2011-2015

- Events: 123
- Sites: 110
- Reports: 74
- Optimization Reviews: 92
- Technical Support: 30

Total 1997 to 2015

- Total Events: 247
- Total Sites: 218

Progress of EPA Optimization Support 2015

- In FY15, the National Optimization Program fully implemented the 2012 National Optimization Strategy.
- In FY15, OSRTI conducted optimization projects (studies or technical support) at 32 sites, including 14 ongoing efforts from FY14 and 19 new projects starts in FY 15.
- Twenty projects were completed.

Mining Optimization and Technical Support

- OSRTI continued its implementation of the mine sites optimization initiative to determine if there are ways to address mining sites more efficiently and effectively.
- OSRTI supported (in FYs 14 and 15) optimization studies at 12 mining sites and reviewed 1 mining site conducted prior to 2014.

Site Support Issues / Lessons Learned

- Virtually all sites can benefit from optimization reviews
  - Some from holistic review / others from targeted review
  - Not a one time activity
- Reviews provide insight on
  - Future site needs, expenditures and schedules
  - Application of most effective technologies
  - Additional opportunities for optimization
  - Long term management
- Optimization methods and level of effort vary per pipeline stage
- New RPMs most interested in performing reviews; repeat customers as well
- Documentation of lessons learned to date can be improved
- May have to spend money to save money – not an easy proposition

Progress Towards Institutional Practice in Waste Programs

- Standardized processes applied to
  - COI, site engagement and kickoff
  - Onsite visits and interviews
  - Report format and development/review/QC process
  - Optimization Report Inventory and Tracking Tool (ORITT) – tool for tracking metrics
  - Optimization Project Log (OPL) – tool for program/project management
- Identifying and applying process improvements to reduce cost and time
  - Streamlined standardized optimization report template
  - "Portfolios": multiple reviews conducted during singular travel events
- Regional management involved in optimization
  - Increased number of sites and level of interest
  - Staffing realities, leveraging program expertise
- Other programs adapting
  - Office of Underground Storage Tanks: 7 Tribal Sites
  - RCRA-LEAN RFI
  - Region-lead Optimization
- Provide access to broad network of optimization support
  - Superfund HQ Mission Support Contractors
  - Regional Remedial Action Contractors
  - Support from other Agencies: USACE , Argonne National Laboratories

Improving Cleanup Practice-Best Management Practices

- Life Cycle CSM – road map to progress
- Characterization, characterization, characterization
  - Need better characterization, earlier
  - Importance of a comprehensive and evolving conceptual model
  - May or *may not* require additional
  - characterization
  - Scoping and planning are essential
- High Resolution Site Characterization for groundwater sites;
  - Tools, platforms for field analysis, sampling
  - Data management
  - Data visualization
- Smart RI scoping
- Managing uncertainty
- Adaptive management techniques
- Managing sites to completion
- Green remediation-reducing the environmental footprint of cleanup
- Flexibility to adapt
- Project management costs – opportunity for saving money
- Understanding incentives, disincentives to change
- Focus on completion strategy for site, exit strategy for stage

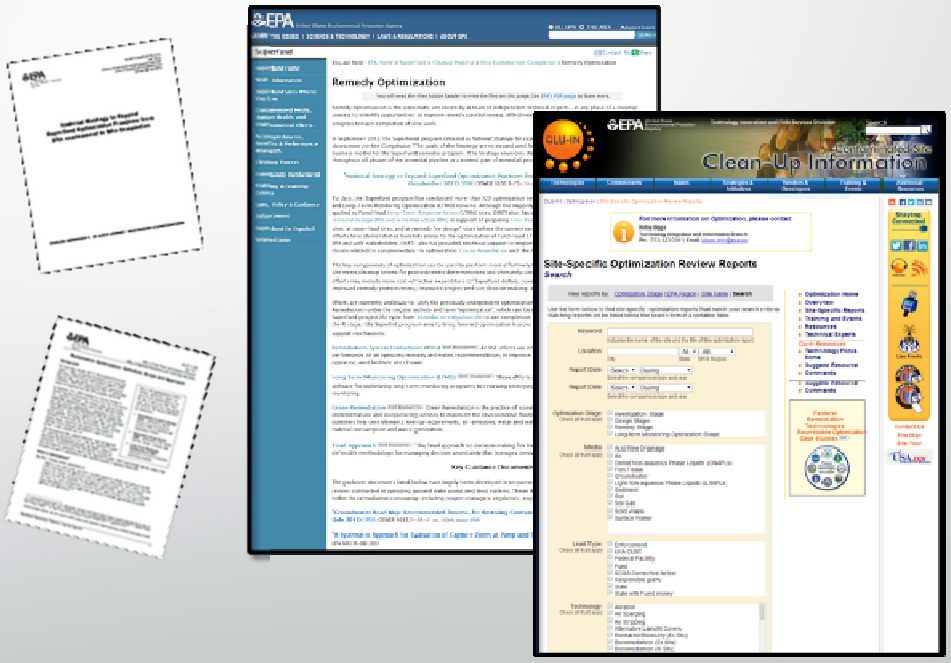
Federal Agency Optimization Policies: Many Federal Partners have embraced both Optimization and Green Remediation

Agency	Optimization Policy (Y/N),	Remedial Phases	Comments
DOD	Y	Post and including Remedy Selection	General requirement to optimize – no specific requirements
Army	Y	Same as DOD	
USACE	Y	Same as DOD, also RA-O	Required optimizations on existing FUDS remedial systems with annual O&M costs>$100,000
Navy	Y	All	Optimization across all remedial phases
Air Force	Y	All	Performance-based contracting (PBC) requires optimization approaches with major focus of achieving accelerated site completion
DOE	N	unknown	Anecdotal suggests some localized efforts
EPA	Y	All	Formal program, selected third party optimizations, also recognizes processes typically used by project team e.g. CSM, TRIAD, GR, as included in optimization

Source:
Dr. Carol Dona
USACE EMCX

EPA Optimization Resources Available on EPA Web Page: www.cluin.org/optimization

- *Remediation Optimization: Definition, Scope and Approach*
- Optimization Review Guides
  - Investigation-Stage
  - Design-Stage
  - Remedy-Stage
  - LTM-Stage
- Site-specific reports
- Summary Reports on Implementation Progress



Questions on Part 1 ??????

Part 2

Part 2:

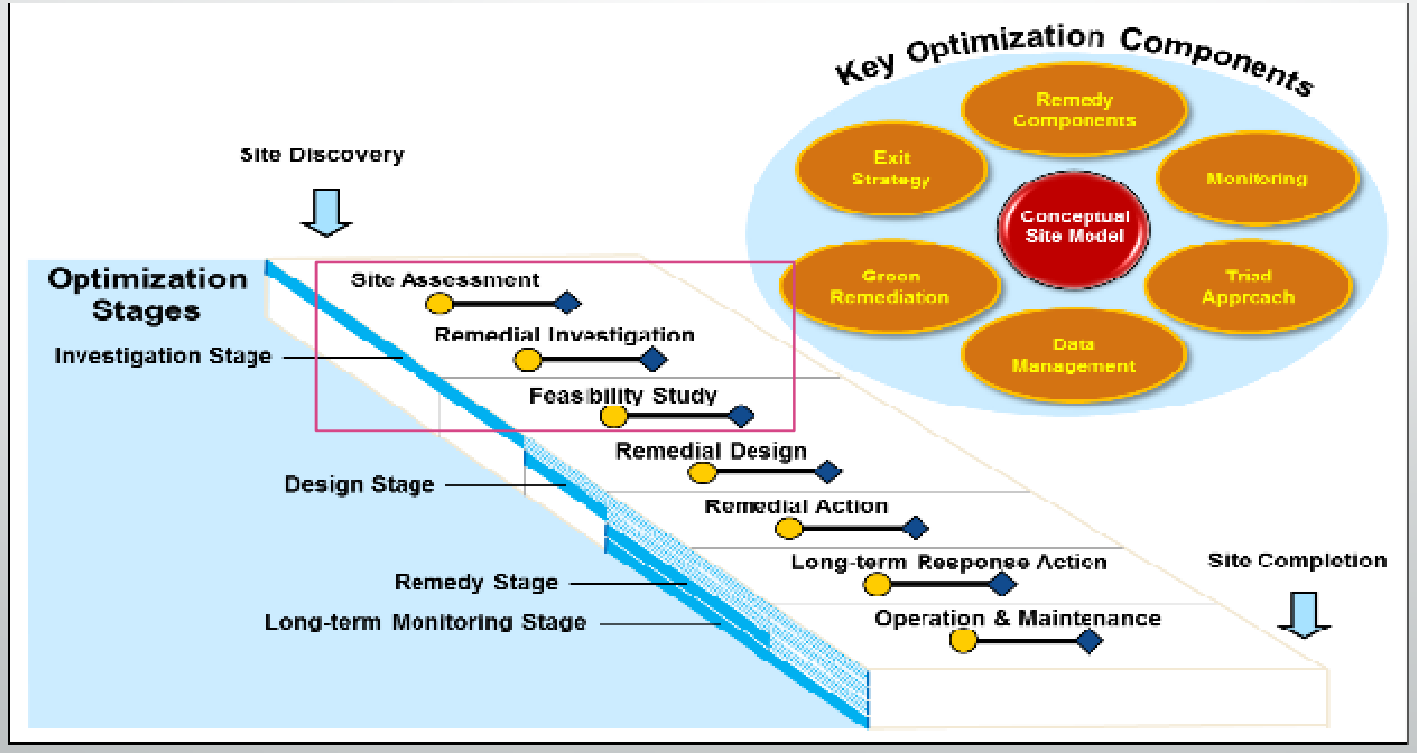
Optimization Stages: What to Expect throughout EPA's "Pipeline"

Does not include additional field work

Investigation-Stage Optimization

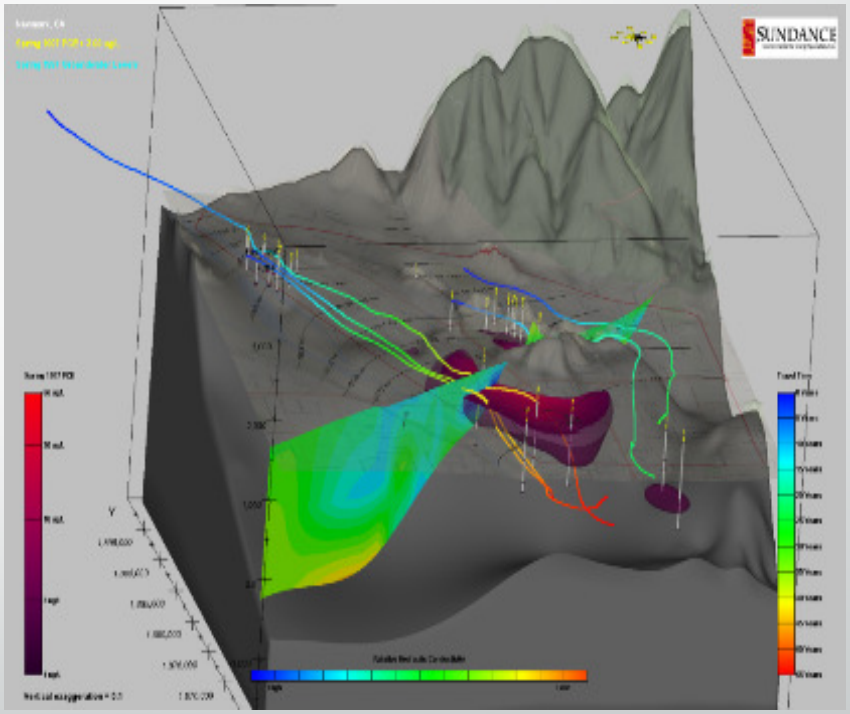
Timing of Investigation-Stage Optimization

- Conducted during any part of the remedial process before the remedy is selected but also appropriate for any remedy that is revisiting investigation and the CSM



Why Request an Investigation-Stage Optimization?

- Uncertainty regarding current CSM
- Highly complex site conditions
  - Multiple sources
  - Multiple plumes
  - Significant subsurface heterogeneity
- Increasing RI costs or scope
- Lack of progression to next stage
- Interest in applying innovative strategies and technologies



Newmark Superfund Site, CA

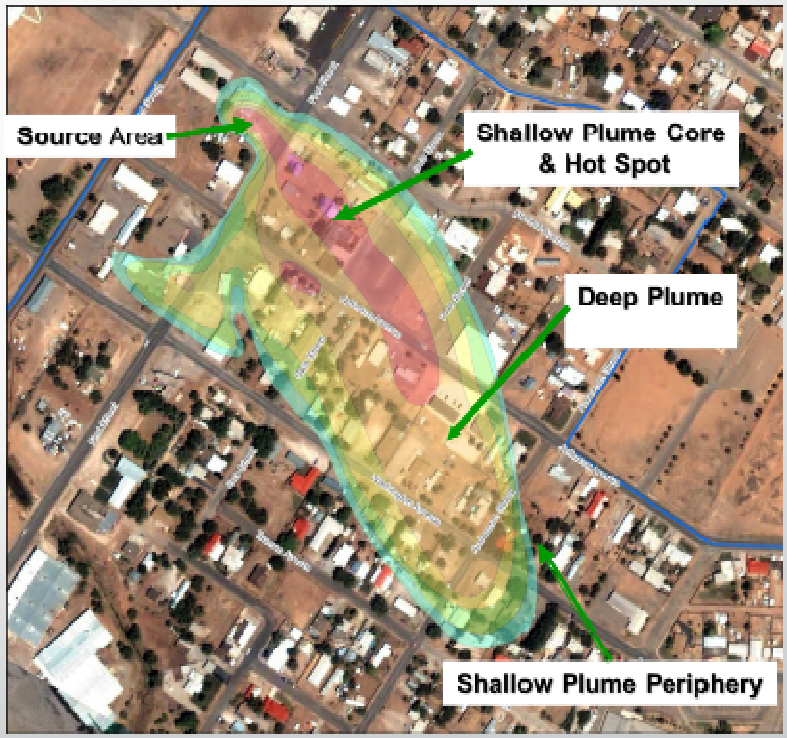
What is Reviewed During the Investigation-Stage Optimization?

- Historical information and data
  - Geology, hydrogeology, chemistry, operations
  - Data quality, usability, net information value
- CSM status and alignment with project life cycle needs
  - Source identification and volume/mass
  - Plume delineation (plume core and dissolved)
  - Completed migration and exposure pathways

Continued . . .

What is Reviewed During the Investigation-Stage Optimization?

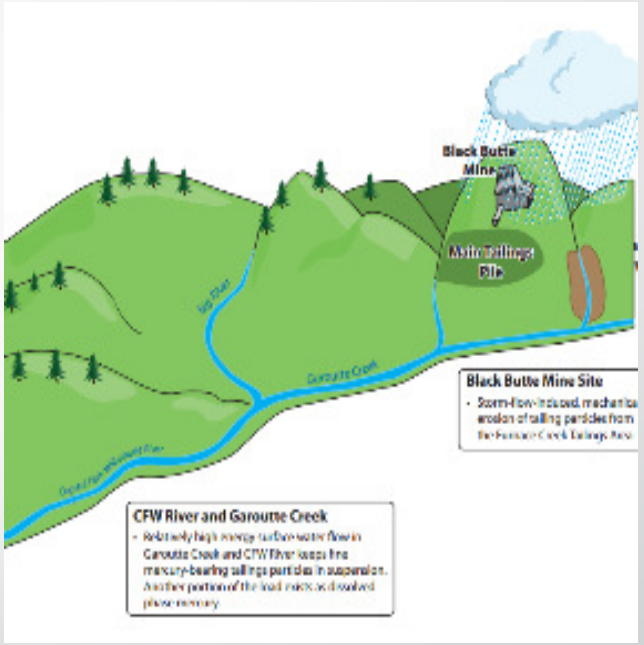
- Technologies previously applied or may apply in the future
  - Analytical, sampling and measurement tools
  - 3-D visualization and analysis
- Stakeholder views
- Completion strategy



Grants Chlorinated Solvents, NM

Common Findings for Data: Investigation-Stage Reviews

- Low data density
  - ↳ High spatial uncertainty
    - ↳ Repeated investigations
- CSM out of date or under-developed
- Existing data not fully leveraged



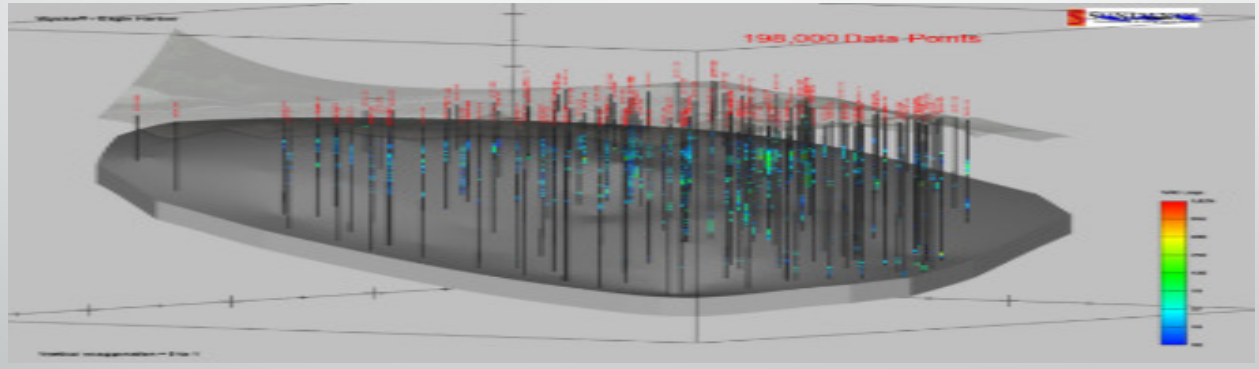
Black Butte Mine, OR

Other Common Findings: Investigation-Stage Reviews

- Strategies and Technologies
  - Use of non-dynamic work strategies
  - Over-reliance on high cost, conventional methods
  - Scale of measurement insufficient to reveal scale of heterogeneity
- End data user needs not adequately considered

Common Recommendations: Investigation-Stage Reviews

- Use systematic project planning and other best practices
- Develop or improve CSM using existing data
- Use 3-D visualization and analysis (3DVA) for CSM
- Investigate based on identified data gaps



Wyckoff – Eagle Harbor, WA

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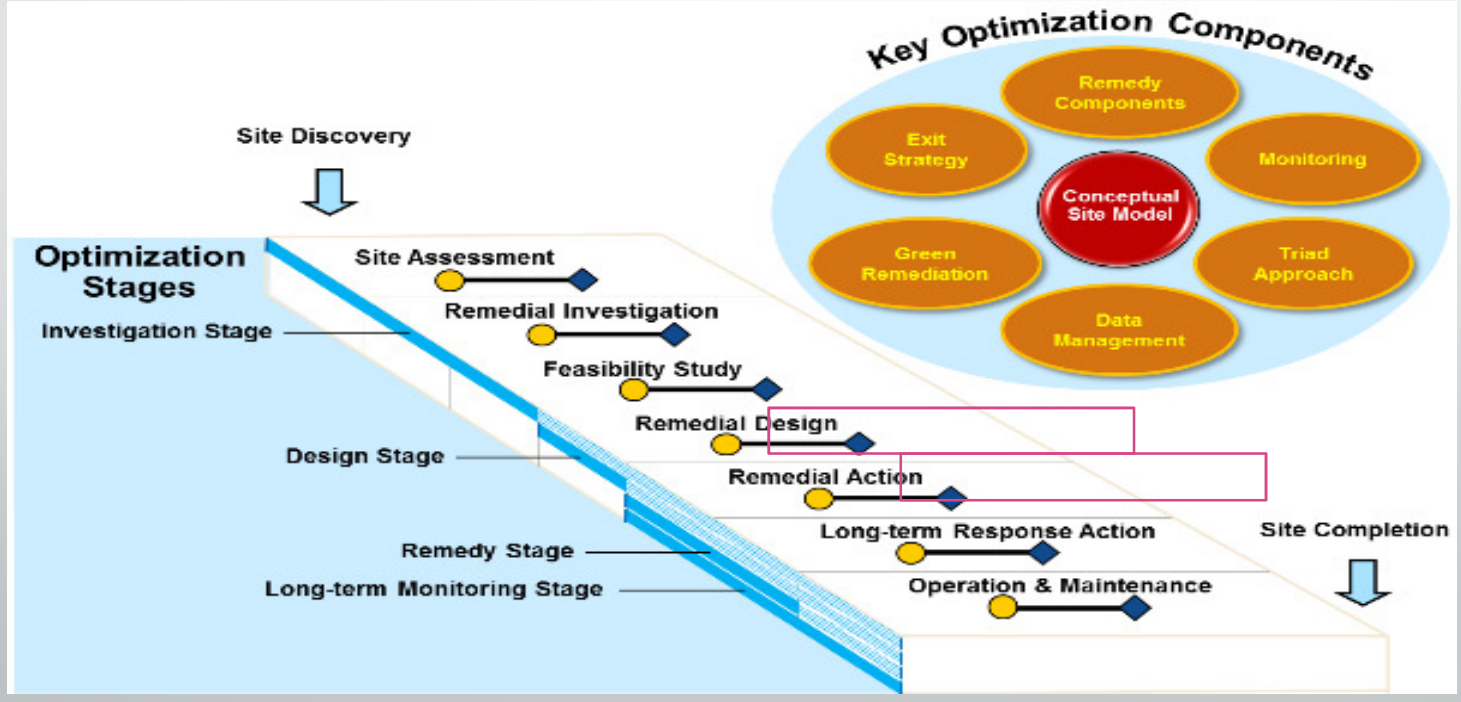
Common Recommendations: Investigation-Stage Reviews

- Perform HRSC using DWS and real-time measurement technologies
- Sequence field investigations to maximize information and resources
- Plan for and collect collaborative data to support risk assessment, remedy selection and design
- Reduce environmental footprint of investigation efforts

Design and Remedy Stage Optimization

Timing of Design and Remedy Stage Optimization

- Design Stage – the period when the remedy is selected but prior to implementation and operation
- Remedy Stage – the period when the remedy is implemented and operated



Why Request a Design- or Remedy-Stage Optimization?

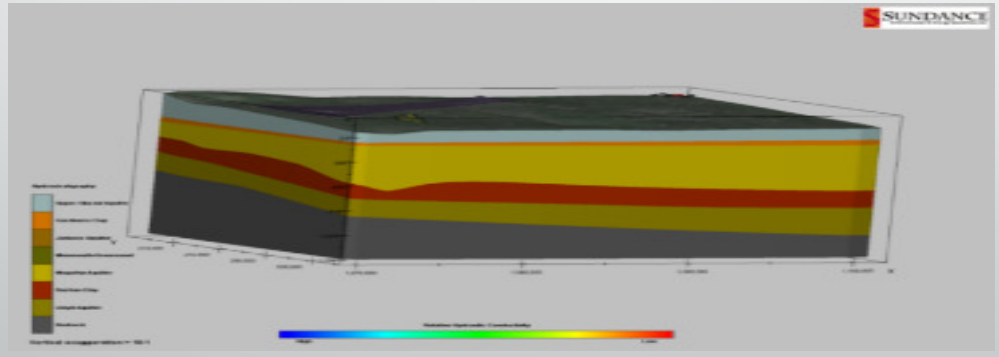
- Concerns regarding planned or actual remedy performance, protectiveness or cost
- To obtain independent assessment of design
  - Value engineering screen and review
  - Independent design review
- Uncertainty about current CSM

Vineland Chemical Company, NJ

Continued . . .

Why Request a Design or Remedy Stage Optimization?

- Interest in using innovative remedial approach
- Uncertainty regarding conclusions or findings from site consultant
- Uncertainties in monitoring plan
- Questions regarding interpretation of monitoring data



Newmark Superfund Site, CA

What is Frequently Reviewed during Design or Remedy Stage Optimization Events…?

- RI/FS Reports
- Decision documents
- Design basis and related data
- Design submittals (including technical memos)
- Work plans for future work
- Pilot test results
- Implementation reports (such as construction, start-up, performance monitoring)

Common Findings: Design and Remedy Reviews

- Gaps in CSM
- Shortcomings in modeling
- Issues in design basis
- High cost estimates

Vineland Chemical Company, NJ

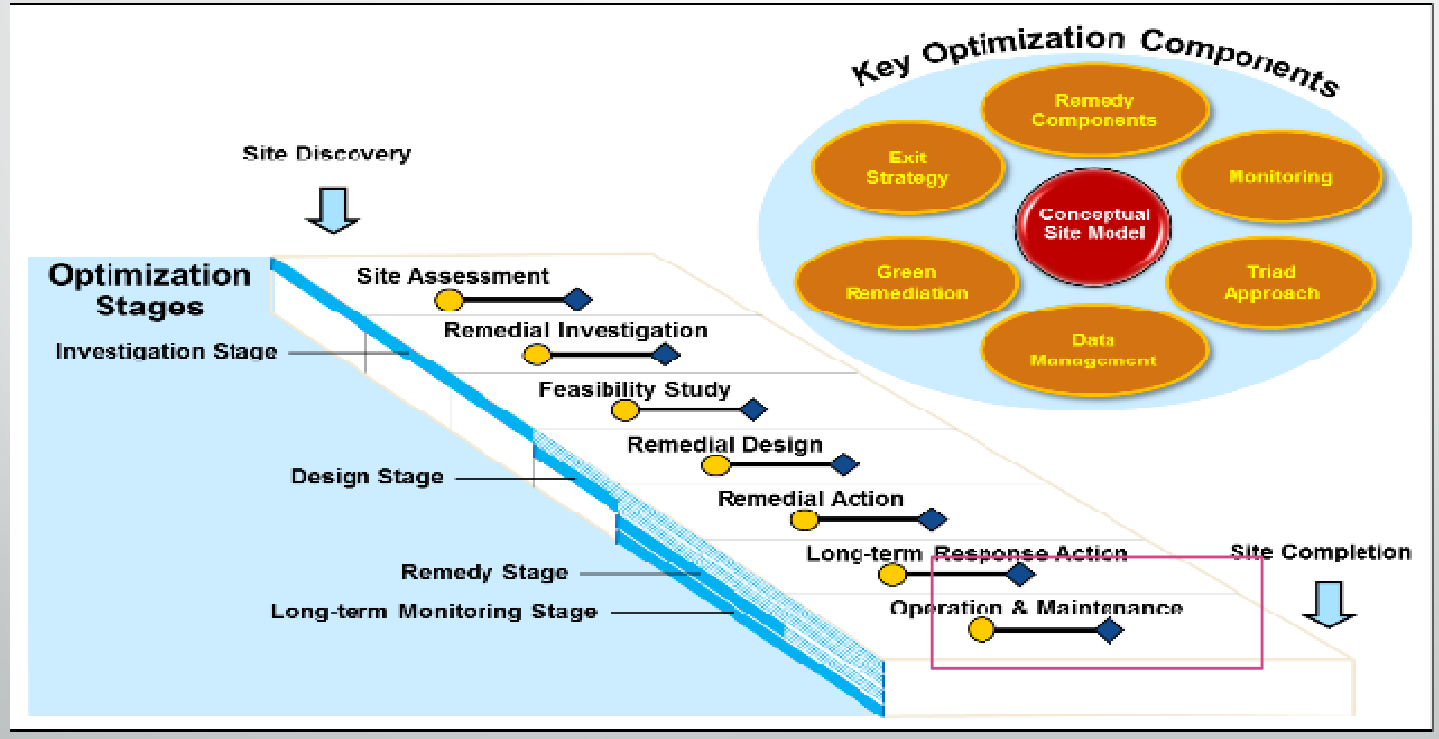
Common Recommendations: Design and Remedy Reviews

- Refinements to CSM and/or design basis through additional monitoring or investigation
- Suggestions for improving numerical model
- Suggestions for reducing/streamlining costs and cost estimates
- Phase remedial components so later components benefit from results of earlier phases
- Consider specific alternative strategies or technologies
- Suggestions for technical improvements
- Suggestions for increasing effectiveness
- Alternative strategies or technologies are available for implementing selected remedy
  - Carefully designed injection wells instead of direct-push technology injections
  - Pre-fabricated system instead of on-site construction
  - Treatment and reinjection instead of discharge to POTW
  - Use of extracted groundwater instead of potable water for reagent blending, injection and circulation

Long-term Monitoring-Stage Optimization (LTMO)

Timing of LTMO

- The 10 year period between the operational and functional (O&F) determination and the start of operations and maintenance (O&M)



Why Request a LTMO?

- Remedy not achieving goals as anticipated
- Cost issues
- Opportunity to reduce monitoring points and costs
- Uncertainty about protectiveness of remedy
- Property re-development needs expedited time frame
- Need to reduce energy and effort and enhance efficiency
- Development or refinement of completion strategy

What is Frequently Reviewed During LTMO?

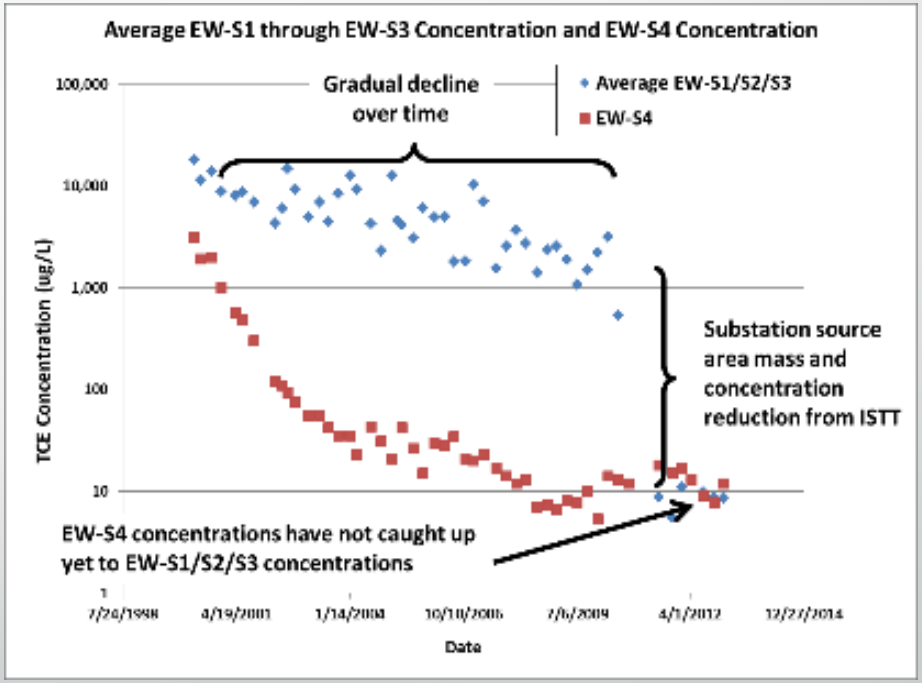
- CSM
  - Original CSM at time of design
  - Changes to CSM since design
- Remedies
  - Remedial objectives
  - Design basis
  - Original remedial design and as-built design
  - Existing performance criteria
  - Performance data – correlate treatment performance with criteria and cost


Groveland Wells, MA

Continued . . .

What is Frequently Reviewed During LTMO?

- Changes in COC concentrations
- Rate of mass removal
- Effluent discharge
- Evaluate costs and effort
- Environmental footprint
- Containment
- Monitoring network



Groveland Wells, MA

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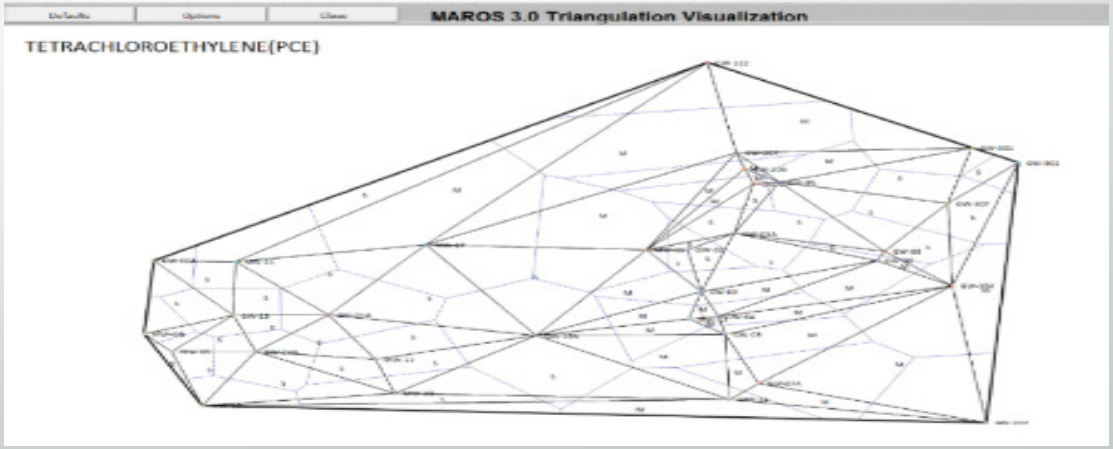
What is Frequently Reviewed During LTMO?

- Extraction and monitoring well locations
- Balance of groundwater extraction rates, capture zone and treatment capacity
- Treatment system and components performance
- Amendment injection amount and location
- Chemical feed rate and storage requirements
- Metals treatment and sludge management



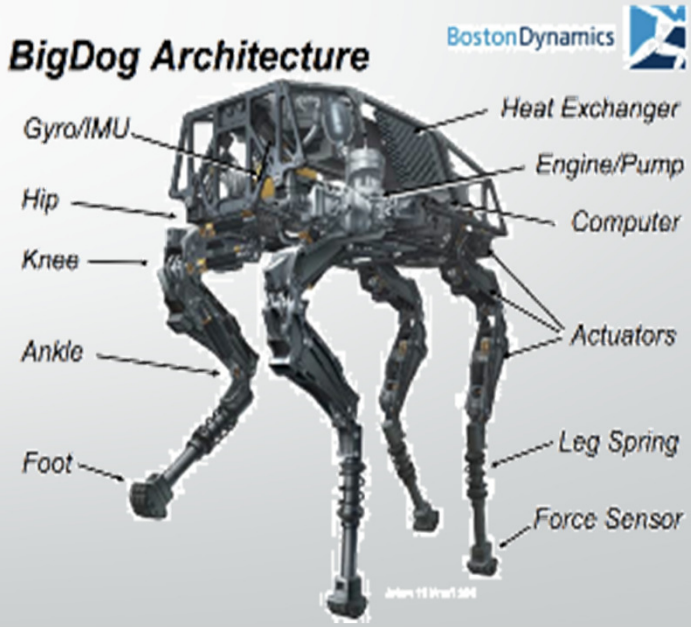
East 67th Street Site, TX

Common Findings: LTMO Reviews

- CSM needs update
  - Conditions since end of active remedy
  - Sources
  - Low and high permeability zones
  - NAPL
- Endpoint and metrics for site completion need better definition
- Need for improved data management, analysis and reporting
  - Tracking and reporting performance
  - Spatial data
  - Historic data (paper → electronic)

Common Recommendations: LTMO Reviews

- Remedy system and components
  - Operational improvements and maintenance
  - Update current system
  - Monitoring optimization
  - Operator costs
  - Reduce excess staff
  - Automation
- Completion strategy
  - How close is site to achieving cleanup?
  - What data are needed to show attainment?



Path Forward For the National Strategy

- Continued Implementation of ongoing strategy elements
  - Annual candidate site identification
  - Further training program development
  - State and Tribal outreach
  - Region-lead projects
  - Recommendations implementation tracking (underway)
    - Cost impacts
    - Benefits (Protectiveness / cost / success stories)
    - Obstacles
- Mining sites
- Federal Remediation Technologies Roundtable Collaboration
- Coordination with other Federal partners

Federal and State Links to Optimization Resources

- EPA Home Page: Remedy Optimization, www.epa.gov/superfund/cleanup/postconstruction/optimize.htm
- EPA Hazardous Waste Cleanup Information (CLUIN)
  - Optimization Page, www.cluin.org/optimization/
  - High Resolution Characterization, www.cluin.org/characterization/technologies/hrsc/
  - Green Remediation, http://www.cluin.org/greenremediation/
- U.S. Army Corps of Engineers, www.hnc.usace.army.mil/Missions/EnvironmentalandMunitions.aspx
- U.S. Army Environmental Command, http://aec.army.mil/
- U.S. Air Force Civil Engineer Center, www.afcec.af.mil/environment/
- U.S. Naval Facilities Engineering Command, www.navy.mil/local/navfachq/
- Federal Remediation Technologies Roundtable, www.frtr.gov/optimization/
- Interstate Technology Regulatory Council, www.itrcweb.org/Team/Public?teamID=4

Questions and Discussion